Claim Amendments:

This listing of claims will replace all prior versions, and listings, of claims in the application:

1. (Canceled)

2. (Canceled)

3. (Currently amended) ~~The method of claim 2~~ A method for solving a finite element model corresponding to a system in which there is a multi-phase fluid flow comprising:

generating a finite element matrix corresponding to the finite element model, wherein the finite element matrix contains a plurality of coefficients;

adjusting the coefficients to obtain the finite element matrix in which on-diagonal matrix entries are non-negative and off-diagonal matrix entries are non-positive, wherein adjusting the coefficients comprises weighting nodes of each mesh element according to a direction of fluid flow across the mesh element, wherein weighting the nodes of each mesh element according to a direction of fluid flow across the mesh element comprises determining the direction of fluid flow across the mesh element and weighting each node more heavily if the node is upstream from the other nodes of the mesh element and less heavily if the node is downstream from the other nodes of the mesh element; and

generating a solution for the finite element model using the finite element matrix using finite element techniques.

4. (Currently amended) The method of claim 3 wherein each node is weighted more heavily if a greater portion of the mesh element is downstream from the node than from other nodes of the mesh element and less heavily if a smaller portion of the mesh element is downstream from the node than from other nodes of the mesh element.

5. (Currently amended) The method of claim ~~4~~ 3 wherein the finite element matrix corresponds to a system in which there are at least two fluid phases.

6. (Currently amended) The method of claim ~~1~~ 3 wherein the finite element matrix corresponds to a system in which there are three or more fluid phases.

7. (Currently amended) The method of claim ~~1~~ 3 wherein the finite element matrix corresponds to a four–dimensional finite element model.

8. (Currently amended) The method of claim ~~1~~ 3 wherein the system corresponds to an oil reservoir.

9. (Currently amended) The method of claim ~~1~~ 3 wherein the finite element matrix is configured to produce a solution which is not physically unrealistic at any time.

10. (Currently amended) The method of claim ~~1~~ 3 wherein the finite element matrix is configured to produce a solution which is non-oscillating.

11. (Currently amended) The method of claims ~~1~~ 3 further comprising discretizing a model of the system to produce a finite element mesh and generating the matrix based on the finite element mesh.

12. (Canceled)

13. (Canceled).

14. (Canceled)

15. (Currently amended) ~~The computer-readable medium of claim 14~~ A computer-readable medium which contains a plurality of instructions, wherein the instructions are configured to cause a computer to perform the method for solving a finite element model corresponding to a system in which there is a multi-phase fluid flow comprising:

    generating a finite element matrix correspond to the model, wherein the finite element matrix contains a plurality of coefficients;

adjusting the coefficients to obtain the finite element matrix in which on-diagonal matrix

entries are non-negative and off-diagonal matrix entries are non-positive, wherein

adjusting the coefficients comprises weighting nodes of each mesh element

according to a direction of fluid flow across the mesh element, wherein weighting

the nodes of each mesh element according to a direction of fluid flow across the

mesh element comprises determining the direction of fluid flow across the mesh

element and weighting each node more heavily if the node is upstream from the

other nodes of the mesh element and less heavily if the node is downstream from

the nodes of the mesh element; and

generating a solution for the model using the finite element matrix using finite element

techniques.

16. (Currently amended) The computer-readable medium of claim 15 wherein each node is weighted more heavily if a greater portion of the mesh element is downstream from the node than from other nodes of the mesh element and less heavily if a smaller portion of the mesh element is downstream from the node than from other nodes of the mesh element.

17. (Currently amended) The computer-readable medium of claim ~~13~~ 15 wherein the finite element matrix corresponds to a system in which there are at least two fluid phases.

18. (Currently amended) The computer-readable medium of claim ~~13~~ 15 wherein the finite element matrix corresponds to a system in which there are three or more fluid phases.

19. (Currently amended) The computer-readable medium of claim ~~13~~ 15 wherein the finite element matrix corresponds to a four-dimensional finite element model.

20. (Currently amended) The computer-readable medium of claim ~~13~~ 15 wherein the system corresponds to an oil reservoir.

21. (Currently amended) The computer-readable medium of claim ~~13~~ 15 wherein the finite element matrix is configured to produce a solution which is not physically unrealistic at any time.

22. (Currently amended) The computer-readable medium of claim ~~13~~ 15 wherein the <u>finite</u> <u>element</u> matrix is configured to produce a solution which is non-oscillating.

23. (Currently amended) The computer-readable medium of claim ~~13~~ 15 wherein the method further comprises discretizing a model of the system to produce a finite element mesh and generating the <u>finite element</u> matrix based on the finite element mesh.

24. (Newly added) A method of predicting fluid flow in a fluid reservoir, the method comprising:

    generating a mesh representation of the fluid reservoir having a plurality of mesh elements defined by a plurality of nodes, each of the plurality of mesh elements representative of a regional portion of the fluid reservoir;

    generating a matrix-based representation of fluid flow comprising matrix elements associated with a mesh element; and

    selectively weighting the matrix elements based on fluid flow direction in the regional portion of the fluid reservoir represented by the mesh element associated with the matrix element by weighting each node of the mesh element more heavily if the node is upstream from the other nodes of the mesh element and less heavily if the node is downstream from the other nodes of the mesh element.

25. (Newly added) The method of claim 24, wherein the fluid reservoir is a hydrocarbon reservoir.

26. (Newly added) The method of claim 24, wherein the matrix-based representation comprises a four-dimensional finite element representation.

27. (Newly added) The method of claim 24, wherein the matrix-based representation of fluid flow corresponds to a system in which there are at least two fluid phases.

28. (Newly added) The method of claim 24, wherein the matrix-based representation of fluid flow corresponds to a system in which there are three or more fluid phases.